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III. *An Account of the sulphureous mineral Waters of Castle-Loed and Fairburn, in the County of Ross; and of the Salt purging Water of Pitkeathly, in the County of Perth, in Scotland: By Donald Monro, M. D. Physician to the Army, and to St. George's Hospital, Fellow of the Royal College of Physicians, and of the Royal Society.*

Read Jan. 23,  
1772.

**A**S no account of these waters has hitherto been published, I thought that the following would be agreeable to this Society.

Of the sulphureous mineral water of Castle-Loed..

Having heard many gentlemen from the county of Ross speak of these mineral waters, I wrote to Sir John Gordon, of Invergordon, and begged the favour of him to ask some physical person in his neighbourhood to send me an account of them, and likewise some of the waters in bottles; and soon after he was so obliging as to send me six bottles of the Castle-Loed, and six of the Fairburn waters, sealed and corked,

corked, and along with them a letter from Dr. Alexander Mackenzy, dated August 9, 1771, containing the following account.

“ The Castle-Loed is a strong sulphureous mineral water; when taken up from the spring, it is as pure and transparent as the clearest rock water; but if kept in an open vessel, or an ill-corked bottle, it soon becomes of a milky sort of foulness, and it loses its strong sulphureous smell in twenty-four hours.

“ The bottom of the well, and of the channel which conveys its water from thence, is black, as if dyed with ink; and the leaves of the aller bushes that fall into the well, or into its channel, soon contract a blackish colour in the water; but when taken out, and dried in the sun or shade, appear covered with a whitish dust, which is undoubtedly sulphur; for, by burning one or more on an ignited shovel, or clear live coal, they produce a blue flame, and emit a very suffocating sulphureous smell.

“ All that I can learn of the operation of this water, from some sensible people of credit and observation, who have drunk it this as well as former seasons, is, that it very sensibly increases the urine, and sometimes remarkably opens the pores; but I do not find, from the report of any, that it purges, though drunk to the quantity of three, sometimes of four, English quarts in the day. Almost every person remarks, that it whets the appetite, and sits light on the stomach. I have been told by several, that they have had head-

“ aches immediately after drinking their morning  
 “ bottle, but of no long duration, nor to any great  
 “ degree.

“ It is impossible to say with certainty the num-  
 “ ber of cures these waters have made, or what par-  
 “ ticular cases have received most benefit from  
 “ using them ; for every person in the county pre-  
 “ scribes the water for themselves, and runs to the  
 “ well, or sends for the water, for every complaint,  
 “ acute and chronic.

“ I have indeed myself directed several people  
 “ with various complaints to drink them. Some  
 “ very foul faces have been quite cleared ; and, at  
 “ this time, a gentleman’s son, nine years of age,  
 “ with a herpes round the neck, which had proved  
 “ extremely obstinate to other means, has got a per-  
 “ fect cure by drinking and washing with them ;  
 “ and his sister, a young lady of eighteen, who, from  
 “ an untoward recovery from the measles and small-  
 “ pox, fell into a sort of habitual erysipelas on the  
 “ face, head, breast and arms, is now using them,  
 “ and, I think, with evident advantage. Some foul  
 “ ulcers on the legs, and one with every appearance  
 “ of a carious thigh bone, have been perfectly cured.  
 “ And a servant-maid in my own family, who had  
 “ been for several years, periodically in the winter,  
 “ afflicted with severe rheumatic pains in her arms  
 “ and shoulders, received remarkable benefit from  
 “ this water, one summer ; in so much, that the  
 “ winter succeeding she had little or none of her  
 “ rheumatic pains, and her appetite and digestion  
 “ were much improved.”

So far Dr. Mackenzy. From others I have been informed, that this water has been used with success in many of those cutaneous disorders commonly called scorbutic, and in curing the itch.

In order to discover the particular contents of this water, I began to examine the bottles, which had been sent me, on Tuesday, the 10th of September, which was about five weeks after the water had been taken up from the well. The bottles were all well corked, and the tops of the bottles had been dipt into melted wax so soon as they had been corked. The water was as clear and limpid as the purest rock water. It had still a very strong sulphureous smell and taste; but it had no other but a sulphureous taste, and it made no impression, on the tongue, of sea or any other salt.

Some of it was poured into different glasses and tea-cups, and different things put into each.

Syrup of violets became slowly green.

A watery tincture of galls occasioned no particular change of colour, but brought a variegated scum, of the colour of a pigeon's breast, to the surface.

A diluted spirit of vitriol mixed smoothly, and occasioned no white cloud, nor more emotion or cloud than if it had been dropt into distilled water, only soon after a number of air bubbles collected at the bottom and sides of the glass; and the same thing happened, when some drops of the strong oil of vitriol were mixed with another parcel of the water.

Each drop of a solution of pure crystallised native fossil alkali occasioned a white cloud, and a white precipitate fell to the bottom of the glass; but each drop of a solution of salt of tartar caused a dark  
brown

brown-coloured cloud, with a precipitate of the same colour.

A shilling and a fixpence, put into two different tea-cups, were presently tarnished, and became of a very dark colour.

Each drop of a solution of silver in spirit of nitre, occasioned a dark brown or blackish cloud, and fell in form of a black precipitate to the bottom of the glass.

Some very white saccharum saturni turned immediately black, and precipitated in form of a black powder to the bottom of the glass.

Four pounds seven ounces and six drachms, (or lxxi ounces vi drachms) were poured into a stone basin, which was put on a sand heat to evaporate with a slow fire.

As soon as the water became warm, it lost its strong sulphureous smell, and there appeared some flakes of a dark brown light earth, which dropt to the bottom. After about one half was evaporated, a very thin pellicle was observed on the surface, which precipitated to the bottom, and when it was reduced to about a pint (lib. i.), it was filtrated through paper, and about  $2\frac{1}{2}$  gr. of a dark grey insipid sediment was separated. This sediment was composed of the dark coloured earthy flakes, which were observed so soon as the water had become warm, and of a small quantity of a whitish, insipid gritty matter, which had formed the very fine thin pellicle. Some of it being thrown into distilled water, and oil of vitriol dropt into it, an effervescence ensued, and the black earthy part dissolved, though the rest remained insoluble; hence the first

part, or black earth, should seem to be of the absorbent kind, the other an insoluble earth, or a felenite. Whether the first earth was originally dissolved in the water by means of air, or whether it was only light particles of earth, which had been blown into the well, and only suspended, I shall not take upon me to determine; but, in looking at the water of another bottle, which was not used in this experiment, I observed, that although the water appeared quite transparent, yet that it contained some particles of light earth suspended; however, these might have been originally dissolved by means of air, but separated afterwards.

The remaining water was put into a small basin, and set again on a sand heat to evaporate; when it was reduced to about three ounces, a pretty firm pellicle appeared, and it was set in a cool place for twenty-four hours; at the end of which time, it was examined; and, besides the pellicle which had formed on the surface, a thin white lamellated and granulated crust had formed, and attached itself to the bottom and sides of the basin. These being all separated, the whole was thrown into a filter; and when the water had passed, and the coffin was dry, there was found remaining gr. xi. of a very white, insipid gritty sediment. This sediment in the mouth feels gritty, and has no taste, being quite insipid: when some of it was put into a glass with distilled water, and a few drops of oil of vitriol mixed with it, a very slight effervescence ensued; but almost the whole remained undissolved, and appeared to be felenite.

The

The water, being again set to evaporate, was reduced to less than an ounce, when it was again filtered, and gr. ii fs. of a residuum separated. This sediment appeared to be nearly of the same nature as the former; but, on putting it into the mouth, I thought I could perceive somewhat, though very little, of a saltish taste, and when thrown into water, it remained all undissolved.

The small quantity of water which was left, was next evaporated to dryness, and there remained in the tea-cup gr. xvii. of a yellowish matter, composed of the thin lamellæ of some salt, and a yellow unctuous or oily substance. It had rose into blisters, and emitted a very strong smell of sulphur, while it yet remained hot.

Some of the saline matter, being put into a solution of the caustic alkali in distilled water, occasioned a white cloud; and the same thing happened when some of it was mixed with solutions of silver in the nitrous acid, and of corrosive sublimate in distilled water.

In order to separate the salt from the yellow oily matter, the sediment was thrown into and dissolved in an ounce of distilled water, and then passed through filtering paper, and evaporated to a pellicle; after which, it was set in a cool place for forty-eight hours, in which time a crystallisation took place, and I separated very near gr. xii. of a salt similar, in every respect, to that of Glauber; but it had still a little of the yellow oily matter adhering to it. This salt had a cool bitter taste; it dissolved easily in distilled water, and when some of the native fossil alkali was added to this solution, it remained clear; though



though when a solution of the caustic vegetable alkali was added, each drop occasioned a white cloud. Some drops of oil of vitriol, let fall on some of this salt, occasioned no effervescence, nor raised any fumes; and when some of it was put on a red hot poker, it rose into blisters, and did not crackle. From all which I conclude, that this was a true Glauber salt.

After this salt was separated, the remaining liquor was left in the tea-cup, and, at the end of four days, it concreted into a yellow cake, which still contained a good deal of a salt; it weighed gr. ix. so that there had been a great increase of weight, from the water the salts had taken up in their crystallisation. This matter was extremely bitter, and had likewise a cooling saline taste. Some of it, put on a red-hot poker, melted, and rose into blisters; it emitted a little smoke, but did not flame; and it had such a very slight sulphureous smell, that it was doubtful whether it proceeded from the yellow matter or the ignited iron; it burnt to a black coal, which tasted somewhat saltish. Some oil of vitriol dropt on some of this matter occasioned very little effervescence, but raised a strong pungent acid smell, which I at first imagined must be that of sea salt; but, from the few marks I have observed of the existence of this salt in a perfect state in these waters, I have since thought, that it might be that of a volatile vitriolic acid, which had been formed by the union of some of the acid of the Glauber salt, with a sulphureous or oily matter, and dislodged by the addition of a fixed acid of the same kind, though perhaps there may be a pittance of a calculareous marine salt  
in

in the yellow ley mixed with the Glauber salt. Having accidentally added a solution of caustic alkali to this mixture of the yellow matter, and vitriolic acid, it emitted immediately a strong smell of hepar sulphuris. This yellow matter I take to be composed of a Glauber salt, and a yellow oily matter common to almost every water, though perhaps in larger proportion in this than in many others; but whether it contains a pittance of sea salt, I think is doubtful; and what makes me still doubt the more, is my having since evaporated 44 ounces of the water, from which I obtained gr. x. of residuum, when the water was at last evaporated to dryness, which I threw likewise into distilled water, and the most of it passed the filtre, and concreted into pure crystals, resembling those of Glauber salt, leaving but a very small pittance of a yellow oily matter behind. However, it will be necessary to have a pretty large quantity of this last residuum, to determine with precision the nature of every ingredient in its composition, and the exact proportion of each.

Having tried as many experiments as I could, with the small quantity of this yellow matter I had, I last of all examined the coffin through which the salts and it had passed. After it was dry, I found that it had increased gr. ii. in weight, and that it was covered in the inside, with a yellowish powder. When part of the paper, with this powder, was lighted with a candle, and the flame extinguished, it smelt strong of sulphur; and, on rubbing a shilling with another bit of the paper, it immediately tinged it yellow, as pure sulphur would have done. From whence, I think, we have reason to conclude, that this powder

contains more or less of a true genuine sulphur, or, at least, of a sulphureous matter.

From what has been said, it appears, that this is one of the strongest sulphureous waters hitherto found in Great Britain, though I make no doubt but that there are many such which have not hitherto been examined: That, in its natural state, it is highly impregnated with a volatile sulphureous vapour, which evaporates soon when exposed to the open air, and flies off immediately when exposed to heat; and that the water then loses its strong sulphureous smell and taste, though we have the strongest reason to suspect that it still contains a sulphureous matter dissolved in it, by some means hitherto unknown to us; for it neither contains an alkaline salt nor quicklime, the two only substances we hitherto know to be capable of dissolving sulphur, and keeping it suspended in water: That it lets drop to the bottom of the well, and of its channels, a fine powder of sulphur, which adheres to the leaves and branches of trees found there.

As this water contains but very little purging salt, and does not operate by stool, sea water, or some purging salt, may be added to the first glasses drank in a morning, when purging is required. Equal parts of the Castle-Loed and sea water mixed together, make a water in most respects similar to the Harrowgate; and probably will be found to answer in most cases where the Harrowgate has been found useful; and it may often be used with more advantage than the purging sulphureous waters, as they sometimes purge people of weak constitutions too freely, and weaken them too much.

Of

## Of the sulphureous Mineral Water of Fairburn.

Dr. Mackenzy in his letter mentioned no more of this than that he believed it to be a weaker water, of the same nature as the Castle-Loed.

I subjected it to the same trials, as it: on opening the bottles, it emitted a strong sulphureous smell, tinged silver, and produced nearly the same appearances as the Castle-Loed when mixed with the same substances, only it remained clear when a solution of the true fossil alkali was mixed with it; the caustic vegetable alkali occasioned a very small light, darkish cloud, and precipitated but a very small quantity of a very light sediment, owing, as appeared afterwards, to this water containing an absorbent or calcarious earth, which probably was suspended by air, and but very little if any selenite.

I evaporated lib. viii. drachm. i. scrup. i. (or 128 ounces, four scruples) of this water with a slow fire. When it was evaporated to one half, it was filtrated through paper; which operation was repeated again, when reduced to three ounces; after which the remainder was evaporated to dryness, and the solid matter left, thrown into distilled water, filtrated again through paper, and evaporated to a pellicle, and set in a cool place for the salts to crystallise.

By these operations, I obtained near gr. ii. of a dark coloured light earth, which effervesced with acids, and dissolved; gr. xv. of a white calcarious earth, which effervesced with and dissolved in the vitriolic acid;—and gr. xxiv. of Glauber salts mixed with a

yellow oily matter ; but I got no felenites, nor any matter which coloured silver, or I had any reason to suspect to be sulphur.

Some of the salt was dissolved in distilled water, and different liquors were dropt into different parcels of it.

Syrup of violets became immediately of a green colour.

Each drop of a solution of silver in the nitrous acid, occasioned a bluish white cloud, which fell to the bottom.

The solution of the fossil alkali mixed clear, as did a solution of salt of tartar, but each drop of a solution of common caustic alkali gave a white cloud ; some oil of vitriol dropt on a little of this salt effervesced, and emitted acid fumes, while it yet was mixed with a good deal of the yellow oily matter ; but after the salt was dissolved in distilled water, and again crystallised, and freed of most of this yellow matter, no fumes were to be observed ; and the acid smell was extremely faint when strong spirit or oil of vitriol was dropt upon it.

This, though it does not appear to be such a strong sulphureous water as the Castle-Loed, yet it may have its uses, and be serviceable to those who have not an opportunity of using the other ; and it may perhaps be useful in some cases, where the other may not agree.

Of the Salt Purging Water of Pitkeathly, in the County of Perth.

There are but few salt purging waters, which have hitherto been discovered in Scotland ; the  
Pitkeathly,

Pitkeathly, situated about six miles from the town of Perth, is the one in most esteem, and the most frequented.

As no particular treatise has been published on these waters, and I wished to know their particular nature and contents, I wrote to his Grace the Duke of Athol, whose seat of Dunkeld is within 14 or 15 miles of the wells, and begged the favour of him, to ask some of the physical people in the neighbourhood to examine these waters, and to send me an account of them; and in consequence thereof, his Grace was so obliging as to send me a letter from Dr. Wood, of Perth, giving the following description of them; and afterwards six bottles of the water, which arrived in spring 1771.

“ The spring rises in a very low marshy ground,  
 “ undistinguishable from any other; but, by the taste  
 “ of its water, it is generally believed to contain  
 “ no mineral principle, but a small proportion of  
 “ marine salts. It acquires somewhat of a putrid  
 “ taste by keeping, but retains its purging quality;  
 “ and it keeps much better in open, than in corked  
 “ bottles.

“ It purges gently, and without griping. An  
 “ adult person drinks commonly a bottle and a half,  
 “ or two bottles, of a morning.

“ In scrophulous and scorbutic habits, it is certainly a most useful water.

“ A new spring has been lately discovered about  
 “ two or three hundred yards from the old one,  
 “ but its waters seem to be much of the same  
 “ strength and quality as the former.”

Since receiving the above account, I wrote to Dr. Wood, and begged to know of him what proportion of sea salts these waters contained, and whether they had any mixture of a bittern in their composition; and I had the following answer, dated Oct. 17, 1770.

“ Since I received your letter, I evaporated a  
 “ Scotch pint (Lib. iv.) of these waters in a white  
 “ stone bason, and I obtained two drachms of a  
 “ salt, which always run *per deliquium*, and would  
 “ not crystallise. I shall try it again in the summer, as at this season the air, being much charged  
 “ with watery particles, may have prevented the  
 “ crystallisation. By dropping a solution of potash  
 “ into three Scotch pints (lib. xii.) of the waters,  
 “ I got eighty five grains of a very fine magnesia.”

The six bottles of this water which were sent to me, arriving at a time when I was much engaged, they remained for several months in the hamper in which they were originally packed; and I did not try any experiment with the water till the 2d of October last. It was then clear and transparent as the purest rock water, only it seemed to have some few particles of light earth swimming through it. It had then a fetid sulphureous smell, resembling somewhat that of a foul gun or of rotten eggs, and it tinged silver in the same way as the sulphureous waters beforementioned; and it had a sulphureous and slight saltish taste. This fetid sulphureous smell, taste, and property of tinging silver, which this as well as most other salt waters acquire by keeping, I suspect to be owing to a fermentation taking place in the water, and slightly uniting some of the fine oily matter

matter with some of the acid of the salts which these waters contain, and thus forming a sulphureous vapour which is volatile while they remain slightly united, but which by a more intimate union would form a real fixed sulphur. From Dr. Wood's account of this water, it is evident that this fetid vapour, or at least the principles which form it, are volatile; for, he says, the water keeps much better in open than in corked bottles..

Each drop of a solution of the fossil as well as of the vegetable alkali occasioned a thick white cloud, that fell to the bottom of the glass. And each drop of a solution of silver in the nitrous acid gave a milky cloud. Syrup of violets became green, and an infusion of galls occasioned no particular change of colour.

A hundred and two ounces, three drachms and a scruple (or lib. vi. unc. vi, dr. 3. scrup. i.) were put into a large stone basin, and set on a sand heat to evaporate with a slow fire.

As soon as the water was warm, it let drop a light dark coloured earth, which gathered in small heaps at the bottom of the basin; and during this time, the water threw up some air bubbles to its surface; when it was evaporated to about a pint (lib. i.) it was taken off the fire, and filtrated through paper: the coffin through which it passed, after being dried, was found to have acquired 21 grains of additional weight; though I could not collect more than 3 gr. of a stone grey coloured earth, which proved to be of the absorbent or calcarious kind, for it effervesced with and dissolved in the vitriolic acid; the remaining additional weight of the coffin, I believe, depended on some of the



the salts of the water being taken up by the spongy filtering paper.

After this, the water was again set on the sand heat and evaporated till a pellicle appeared on the surface; and during the evaporation it threw up a great number of air bubbles: after this, it was set in a cool place for three days, at the end of which time there appeared a quantity of thin lamellæ, mixed with a small granulated salt, covered with a light coloured yellowish liquor; these I separated, and threw the liquor into filtering paper; and by these operations I got  $53\frac{1}{2}$  grains of a Salt which tasted sharp and salt, besides what had been taken up by the coffin, which had increased gr. 9. in weight more than I had got of salt. This salt being put in a tea cup appeared next day white, and had contracted a little moisture, but did not run *per deliquium*.

The remaining water which was now a yellowish ley, was again evaporated to a pellicle, and I separated a quantity of white salt in lamellæ, which remained moist, till it was set in a tea cup on the sand heat and evaporated to dryness, when it weighed one drachm and 14 grains; this salt attracted more moisture than the former, and seemed at first as if it would run soon *per deliquium*; but the next day it remained in the same state.

As I imagined that both this and the salt before separated was mostly sea salt mixed with a bittern and oily matter, which prevented the crystallisation; I dissolved the whole of both in distilled water, and evaporated with a very slow fire till a crystallisation began to appear, and then set it in a cool place, and got some large perfect crystals of sea salt, and by repeat-  
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ing this several times, I obtained a full drachm of perfect crystals, which diminished in their size as the process advanced; and afterwards a scruple more of thin lamellæ, which on examining with a magnifying glass appeared to be made up of small square crystals; there remained a small quantity of a salt ley, which probably would have yielded a few more such lamellæ.

The liquor which remained after the two first parcels of salt were separated, was next evaporated; but no pellicle appearing, the operation was continued till it was quite dry, when it formed one transparent yellow or amber-coloured salt cake, which weighed one drachm and 34 grains. This salt on being put into a tea cup, presently began to run *per deliquium*, and dissolved entirely by standing in a cupboard which was in a room where there was a fire; but the fire having been let out in the evening, and the night proving cold, I found next morning that a crystallisation had taken place, for there was a crystallised cake at the bottom of the cup, which was covered with an amber-coloured ley; it at first seemed to be all one piece, with a number of small points standing up on its surfaces; but on reclining the tea cup to a side, it then appeared to be made entirely up of a number of oblong crystals about the length of a barley-corn, but not so thick, and that the points beforementioned were the ends of these crystals. Not having time to examine them particularly in the morning, and to know their exact figure and number of sides, I set them by, till I should come home again about one o'clock; but the day proving warm, they were mostly dissolved before that time.

Oil of vitriol, dropt into a tea cup in which there was some of this ley, immediately occasioned a white  
firm

firm coagulum like chalk, which was insoluble in water, and, when well washed and freed of its acid, felt gritty and was quite insipid in the mouth; this is certainly a selenites formed by the earth of this ley and the vitriolic acid.

From this account of the Pitkeathly waters, it appears that lib. vi. unc. vi. dr. 3. scr. 1. besides a few grains of an absorbent or calcarious earth, contain three drachms,  $41 \frac{1}{2}$  grains (besides what was lost in filtrating and other operations) of a saline matter, of which near two thirds were sea salt, the rest a bittern or salt with an earthy basis, which concreted by the force of fire into a yellow saline mass, that runs soon *per deliquium*, and crystallises though with difficulty.

The small quantity I had of residuum prevented my being able to determine with precision, the exact proportion of sea salt and of this bittern; neither was I, for the same reason, able to determine whether this bittern or ley was all made up of a calcarious marine, with an oily matter common to all waters, or whether it contained likewise a sal catharticum amarum with a vitriolic acid.

From the acid of vitriol forming an insoluble selenites with the earthy basis of this bittern, it is evident, that at least all the earthy basis is not a magnesia, such as makes the basis of the sal catharticum amarum of the shops, or what goes by the name of Epsom salts, otherwise it would have formed a salt easily soluble in water.